

***Developing an Orphanage in the Third World:  
Rethinking Local Haitian Architectural Vernacular***

An Honors Thesis HONRS 499

by

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## Abstract

The need is great to design and develop building technologies for the underdeveloped and third world nations. With a passion for underdeveloped nations as well as design, I pushed this project to explore varying degrees of design in an uncommonly taught platform of a third world country. I aimed to realistically understand what typical building constraints were valid and which ones I wanted to challenge. I strived to understand the feasibility of building with typical local materials but push the boundaries with form, design, and structural reinforcements. I found a great richness in the concepts of community and gathering spaces that are integral to Haitian dwellings. Through investigating various local materials, gaining significant understanding of natural climatic forces, and the power of passive heating and cooling systems, I was able to push the envelope of design. The results were a schematic design for an orphanage complex, which challenged typical Haitian building techniques and explored other possibilities while still staying true to important aspects of Haitian architecture vernacular.

# Acknowledgements

Fr. Andre Slyvestre  
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Walter Grondzik  
Bob Fisher  
Robert Koester  
Dr. James Ruebel

My fellow College of Architecture students, in particular Anne Schneider, Melissa Schnulle, Elizabeth Avenius, Madeline LePlante, Dru Furbee, Yung Hong, and Christopher Robin Rhoads who helped me develop ideas, gave constructive criticism, encouraged my design, and led me to reach an even better product.

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## Designer's Statement

When a tumultuous earthquake rocked the small island country of Haiti in February 2010, an entire city crumbled, devastating the poorest country in the Western Hemisphere. What this cataclysmic event brought to the forefront of media and the design world was the lack of building safety standards upheld in Haiti, a similar story found throughout the world in impoverished areas. The earthquake also left the country of Haiti ridden with people without any family, many who are children – homeless and orphaned.

A Haitian priest I knew from when he was studying in the States named Fr. Andre had just returned to Haiti before the February earthquake occurred. His dream for many years was to build an orphanage for the lowliest of children. As the after effects of the natural disaster were felt, he began organizing a place that orphaned children could call home. In a document Fr. Andre sent out to his supporters, he states: "I feel a calling to try to help some of the orphans. My dream is to build an orphanage complex that I would like to call Orphanage of Our Lady of Perpetual Help where the orphans can have the privilege to feel loved, to have access to education and health care, to hear the good news of the gospel, to learn how to shape their own destiny." In the spring of 2010, Fr. Andre leased a house for three years until a permanent home could be constructed. By the late fall, early winter of 2010, he had 15.5 acres of land but no designs with which to construct anything. The basis, structure, and design program for this project was formed upon learning this information and realizing the eminent need for design in this context.

What started as a design project for a 402 architecture studio grew and developed into my honors thesis. With both the 402 studio and the honors thesis being a representation and culmination of one's academic pursuits – I felt this project was a perfect fit. After having spent three semesters studying a mixture of third world design, sustainability in under-developed countries, and researching the manufacturing of concrete masonry and its uses in Haitian construction – this thesis design project would prove to utilize all this prior information learned and apply it to a real world design problem.

This project aims specifically at understanding the local building culture, and what local people build with and how. Understanding a culture's building methods allows the chance to see where their strengths and weaknesses are. Once this is achieved, one can begin to rethink the local architectural vernacular and break through to a redefined way of building locally in the setting studied.

### **Precedent Studies**

Two precedent studies launched me into the design process. I took a look at work being done by Ethiopia Studio – a studio of graduate students from Arizona State University led by Jack DeBartolo developing an orphanage in rural Ethiopia. From their project entitled “Wolaitta Village”, I better understood designing clustered residential units in warm climates. It gave me some backbone to the types of programmatic needs an orphanage in a second/third world nation might need or expect to have. I was able to review a few of the case studies the students had posted to their website as resources. It helped me start to understand utilizing local building materials to a higher level.

I also studied the work of Anna Harringer, a bold architect and designer who has been internationally acclaimed for her earthen structures in rural Bangladesh. What I took away from studying her “Handmade School” was not only how it was possible to build with earth and reinforce with bamboo, but how elegant and beautiful this type of structure could be. Furthermore, she demonstrates a great model of developing small teams to go educate local people about building with these types of materials, equipping them with essential knowledge skill sets. Harringer co-led the village as they “hand made” their own school building. The benefits to this are many – one of the primary ones being that the village will know how to repair the building as time progresses. Since it was constructed of rammed earth, should the day come that it would be abandoned and not used, it could simply return to the earth.

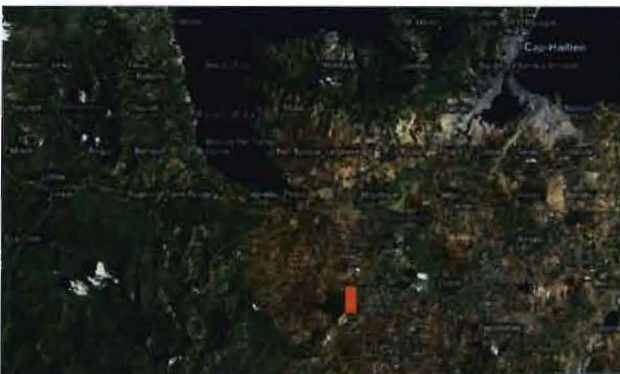
Pulling valuable lessons learned through understanding the program, design, and project of each, I began solving my own design enigma.



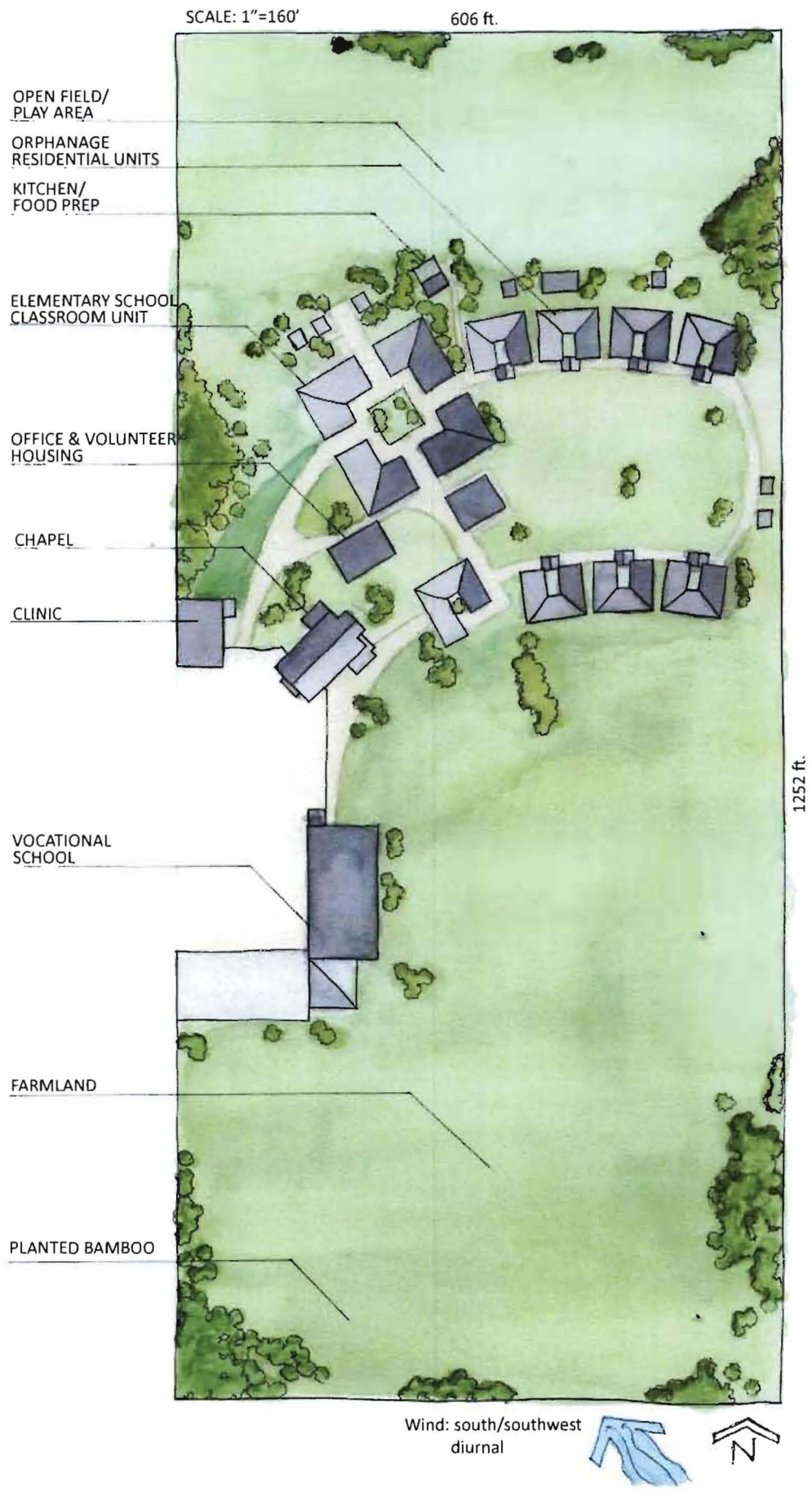
## Program & Site

The location of the site is in Galois, Plaine du Nord – the north plains of Haiti. It is about 10 miles southwest of the northern capital of Cap Haitien. It is a quite rural site, situated in an area known to generally have good cropland with nearby savannas and a few open pastures.

The design program was modeled from a combination of the precedent studies of other orphanages done in third world nations, as well as my communication with Fr. Andre to determine what his goals for this orphanage complex were.



# Site Plan



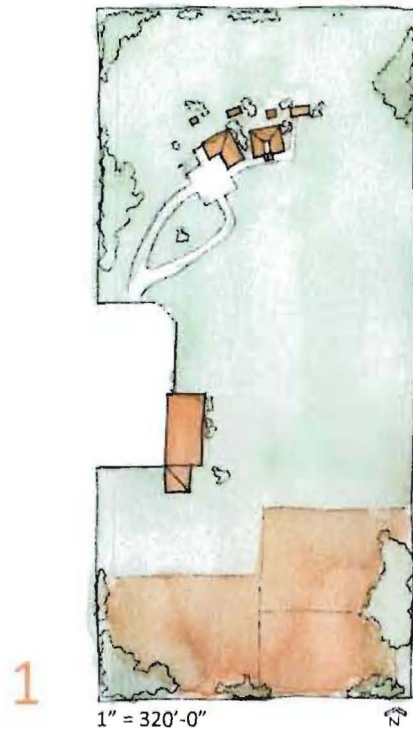


latitude: 19.3  
longitude: -71.7  
elevation: 3,034 ft  
site area: 15.47 acres

- warm & humid
- rainy season: April - May  
Aug. - Oct.
- hurricane season: June - Oct.

<b>Site</b>	15 acres (653,400 SF)
- Entrance area on site	360 SF
<b>Orphanage</b> with capacity to begin serving 30 children (100 later):	
- Dormitory/sleeping area (7 @ 1,500 SF per unit)	10,500 SF
+ includes a multi-purpose living space	250 SF
- Nursery	500 SF
- Dining area/multipurpose room	800 SF
+ designed with expansion in mind	
- Food Preparation	300 SF
- Bathrooms (7 @ 100 SF) & showerhouse (200 SF)	900 SF
- Staff residency areas (2 rooms @ 250 SF)	500 SF
- Staff office/main office	300 SF
- Guest area (sleeping for visiting people, 2 rooms @ 140 SF)	300 SF
<b>School</b> (K-8):	
- 10 classrooms (600 SF room)	6,000 SF
- Library space & a flex room	1,200 SF
<b>Vocational Training Centre</b>	3,600 SF
+ to train older children/citizens in job skills	
+ carpentry, electricians, masons, plumbers,	
car technicians, aid nurses, teachers, and others	
<b>Gardens/Farm</b>	60,000 SF
+ compost area	100 SF
<b>Chapel</b> – seats 100 people	2,500 SF
<b>Clinic</b>	600 SF
<b>Subtotal</b>	88,460 SF
Mechanical (emergency generator)	150 SF
<b>TOTAL</b>	<b>88,610 SF</b>

# Phasing Diagrams

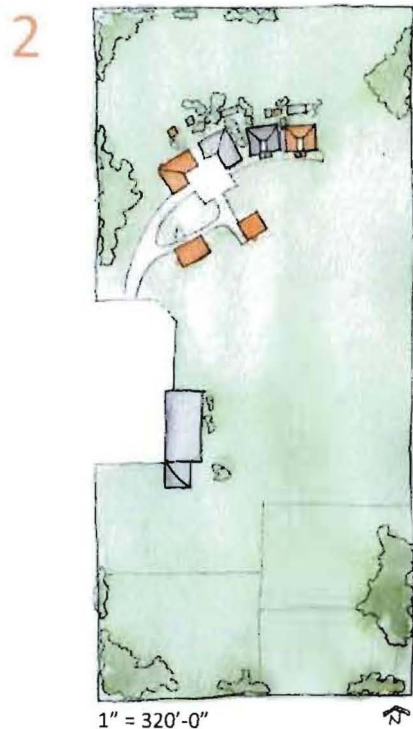


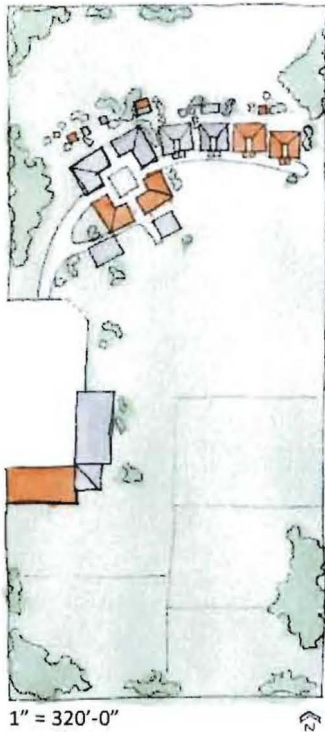
## PHASE 1

- Begin cultivating the site
  - + plant bamboo, coconut, sugar cane, & other crops.
- Build 10' wall around side for safety & security
- Build 1st half of vocational school to be used as a warehouse and as storage
- Build 1st unit of both classroom and residential, as well as supporting facilities
  - + one room of classroom unit is temporarily to be used as a chapel, one as the clinic

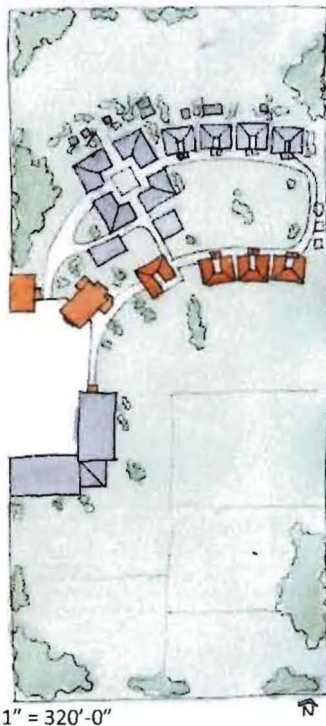
## PHASE 2

- Continue further cultivation of land
- With an increase in children/ students, build addition units
- Build office space and open multi-functional pavilion





3



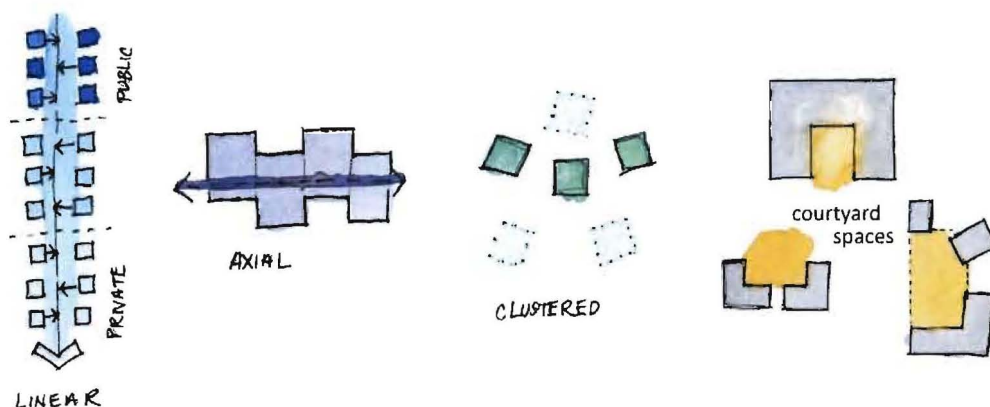
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### PHASE 3

- Continue building addition units as orphanage is able to serve for children
  - + add space to kitchen & build additional supporting facilities
- Build 2nd half of vocational school
  - + begin teaching local neighbors & young adults trade skills

### PHASE 4

- Move chapel & clinic from rooms in the school to their own respective buildings.
- Build housing for cloister of nuns
- Continue adding more residential units.
  - + These last few are dedicated to the older children.



It was important to organize the site through a multitude of factors – one of the most important being safety and security. This program is very multifaceted with public, semi-public, and private uses. Most particularly, I felt it crucial to consider the safety of the children and that there were various “gatekeepers” that outside people would have to go through in order to enter. The second set of factors to keep in mind dealt with the local cultural context, recognizing which spaces were important to harness in the design. I found that having designated social and community space where people could gather was central to Haitian communities.

Addressing these two issues, they were blended together in the creation of a large community-gathering, courtyard space. This would be the most public of places on the complex and is where those needing care at the clinic, attending the vocational school, or going to the chapel would come. Separate entrances from the courtyard allow access to each of those three facilities, yet people would not be allowed to exit through other routes except into other public areas.

The master plan of the site was designed with the idea of expansion in mind. The vision is depicted through a series of phasing diagrams. What starts as just a few buildings grows as the complex needs it to grow and serve more and more children at the orphanage. In order for this to work fluidly, it became clear that investigating various types of additive forms were needed. Throughout the master plan, you can notice a mixture of clusters and axial forms organized along a curved linear axis.

### **Materials. Systems. & Resources**

Unlike the United States, much of Haiti does not have the benefit or the resources to run HVAC (heating, ventilation, and air conditioning) throughout their buildings to provide thermal comfort for their occupants. This proved to be an interesting design challenge. With sustainability and the “green” revolution becoming a popular notion not only in society but also through the design profession, many architects are looking back and learning from the natural systems indigenous people utilized for centuries, prior to heating and air conditioning. In this same fashion, it was important to re-educate myself on some of the basics in natural cooling systems and properties of wind patterns.



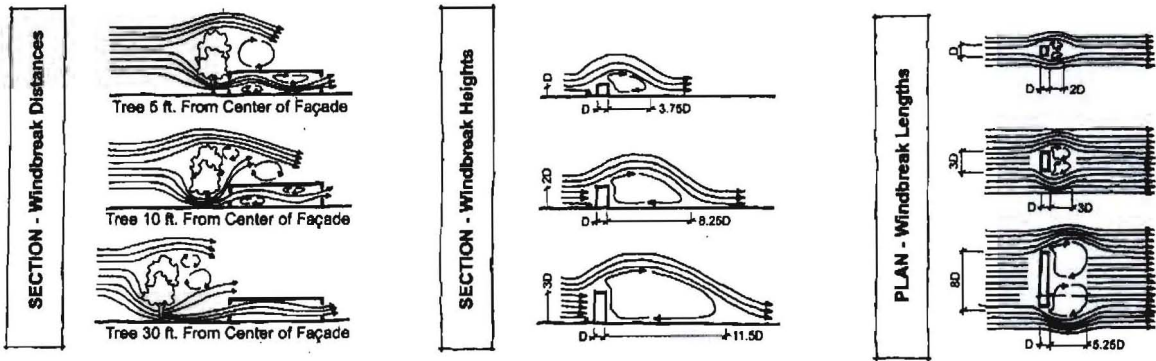


Image source: Stein 70

The wind on site comes predominantly from the southeast. Also, since the island is relatively small in size and Galois, the district the site is located on, is so near the northern coast – this site experiences diurnal winds. Through careful study, testing, and positioning of the various buildings on the site plan, I was able to find ways of increasing airflow through many of the buildings allowing increased thermal comfort within the various living spaces. Much of my testing was done on a fluid water-mapping table. The wind diagrams shown above graphically describe important factors to keep in mind when considering the placement of buildings on site.

With Haiti's location so close to the equator, it's potential for solar energy utilization is quite great. There are many hurdles to overcome in Haiti regarding the use of solar power to create electricity. Some of these hurdles include a lack of technology with little to no infrastructure, and a lack of access to solar power generating materials. If these were solved, this site could greatly benefit from the solar energy possibilities that exist. On a smaller scale, solar ovens are becoming more accessible in nations such as Haiti and when constructed properly, they are just as efficient as the coal burning stoves many Haitians cook on. The benefits to cooking with solar energy are much greater than coal for at least two reasons. First, coal releases many toxins in the air leading to poor local air quality. Second, coals come from trees. Deforestation is one of Haiti's largest environmental problems. It is leading to poorer soil quality, which means less than fertile land on which to farm. Also, without tree roots to help stabilize the clay-based soil, erosion is occurring everywhere.

The earthquake in Haiti revealed the poor ways in which many Haitians build their most popular type of building construction – concrete masonry. Weeks after this earthquake hit Haiti, another struck along the coast of Chile. It was said to be more than 500 times stronger. Yet, Chilean concrete masonry buildings fared better than in Haiti. In Chile, buildings may have just split in half where in Haiti they crumbled. The main reason for this was that in Chile buildings are designed with reinforced and confined masonry construction techniques. These techniques include symmetrical building forms and placing openings such as windows and doors in the buildings strongest areas. If you look at most of the plans to many of the buildings on site, they are symmetrical in form.



Haitian concrete masonry, when produced, often is not mixed with the correct ratio of sand, cement, gravel, and water, or cured with the correct moisture content or amount of time. This leads to very poor compression strength in the material and to greater possibilities of crumbling or explosion under pressure. This is why including a vocational school on site to educate local masons and construction workers is so crucial to creating better, safer, and stronger buildings not only on the orphanage complex but also throughout Haiti. Education and instruction is the biggest tool for better building safety.

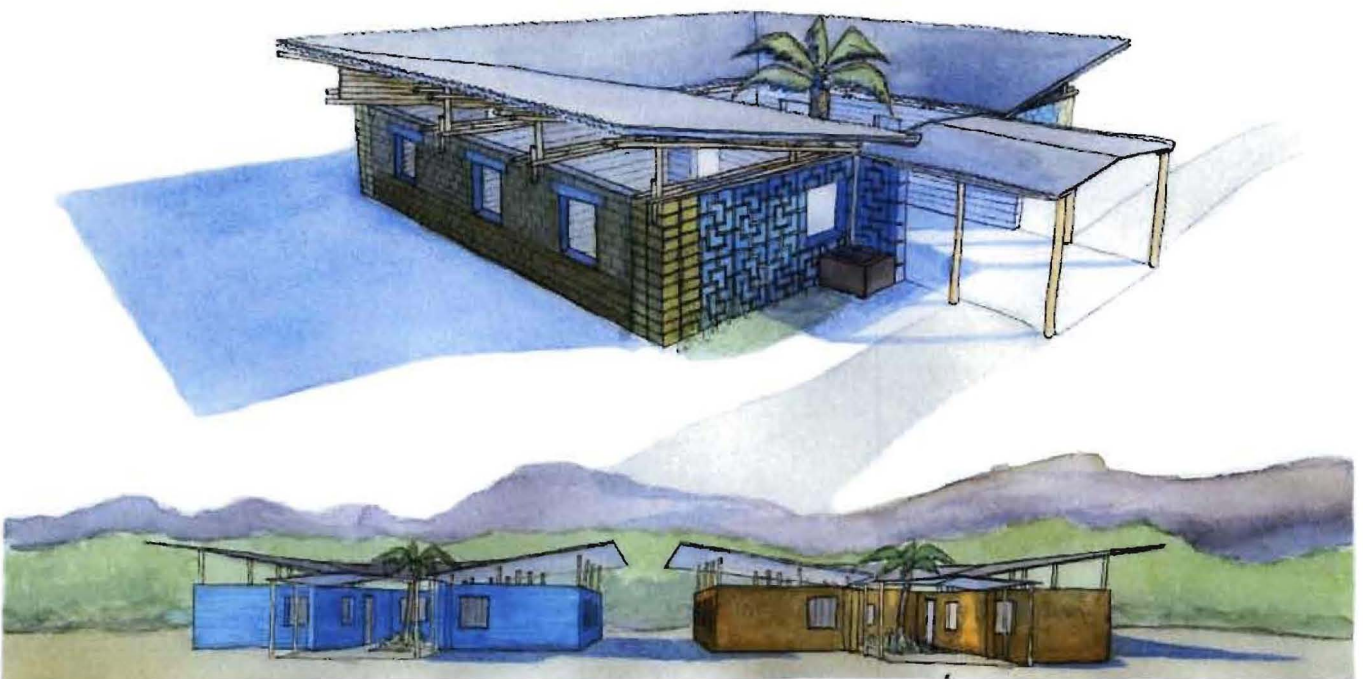
It is also essential to understand that some building materials aren't readily accessible on the island of Haiti. The major material is structural steel. Steel, not being manufactured on the island, is all imported from Cuba. Much of the steel rebar, used for reinforcing concrete and concrete masonry structures, is typically all the same size – a number 4. This is important to note, because in order to construct a safe two or three story building, you should use steel rebar numbers higher than 4. So for the safety of building occupants, all buildings were designed as one story spaces. This leads me to also explain that while all these buildings could be built and reinforced with steel, this is a costly material, high in demand, but limited in quantity. There are other construction reinforcement techniques that have been researched in various places around the world involving the use of bamboo as opposed to steel. It has been tested to have similar strength characteristics and has the possibility, if used in construction correctly, to revitalize and revolutionize how buildings in Haiti are built and reinforced. (Xiao) Bamboo could be grown on site, allowing you to grow some of your possible building materials.

### **The Roof**

The butterfly slope of the roofs allows for better interior ventilation and airflow – as tested on the water-mapping table. This unfortunately doesn't lead to much shading of each individual building. If you step away from the individual building and look at the buildings as a community of structures working together, you can then utilize the shading one roof provides as significant shade for its neighbor. In this way, with the addition of a vertical fin screen between buildings when needed and strategically placed trees, shade can be provided for much of the day on many of the building surfaces. This allows for less radiant heat transfer from the outside of the CMU wall into the interior living spaces.

The shape of the roof also affects how water can be captured for various clean water filtration processes, to then be used as potable drinking and cooking water. It also could be harvested in rain barrels for irrigation and other grey water purposes.

Coconut fiber is made from one of the byproducts of coconuts – its outer husks. Since it has large thermal and acoustic insulation properties and is highly resistant to rot, it has great potential to be used as a successful insulating material between the corrugated steel roof and the living space below (Zarr). Cornstarch can be used as a simple yet effective binding element. A benefit to using coconut fiber as an insulator is this fruit could be grown on site as a crop in the fertile farmland. It could serve as food for the orphanage, providing coconut flesh and milk to the children. The surplus could be sold for a profit at a local market. An alternative to coconut fiber would be using sugar cane fiber – another crop that could be grown, harvested, and sold from the site. Both coconuts and sugar cane are common crops found on the island.



### **Design Challenges**

One of the largest challenges in this project was the difficulty which resided in the type of project it was – one located in a third-world nation, on a site I could not visit personally, and where local resources and building technology were greatly different. I recall feeling as if I was being torn and ripped apart by two design parallels – that of the Western developed world and that of the realities of a third-world nation. The cultural and economical constraints placed upon the project far outweighed the complexity of program. I found myself in an interesting design situation not wanting to simply design a basic shelter with the bare essentials in it for the Haitians, with it seeming like I'm just continuing their "poor" standard of life. But the reality is, their culture is far different from ours and some things we think are barbaric, such as bathing in the river, are normal – even preferred – day-to-day activities for them. In understanding that many things desirable in the United States won't generally fit the context of Haiti, the importance of cultural sensitivity and awareness became clear.

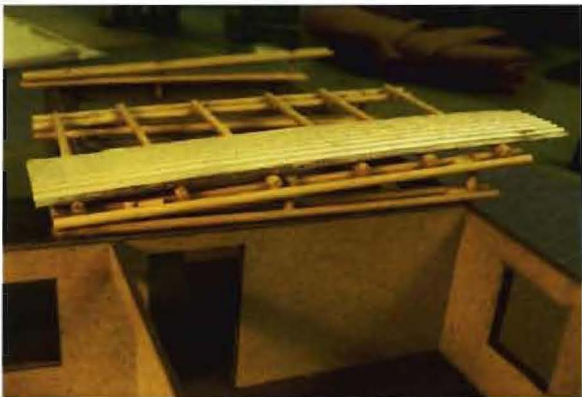
I'd like to come back to the notion of a "basic shelter" and discuss concepts Amos Rapoport mentions in *House Form and Culture*. Our modern studio design culture seems to honor inventiveness and innovation above tradition. This begins to explain why the first half of this project was so difficult – because in my subconscious I felt a pressure for my ideas to be new, fresh, and revolutionary. Since originality has such a high premium, the result is a society dissatisfied with traditional forms, and the vernacular process can no longer work. "In most traditional cultures, novelty is not only not sought after, but is regarded as undesirable" (Rapoport 7). Rapoport also discusses that while the scarcity of materials and resources is not the driver for form, "it does make some solutions impossible and reduces the choice to an extent, depending on the severity of the limitations. Together with the limitations of technology, it has considerable effects on form, since the possible variety is reduced. This exemplifies the concept of the scale of criticality, paralleling those relating to climate and wealth" (Rapoport 105). Getting a grasp on these two concepts allowed me to reexamine Haitian vernacular architecture through the lenses of its tradition and culture instead of through an American way of thinking. The concept of simple, basic forms became elemental to the design of the orphanage complex.



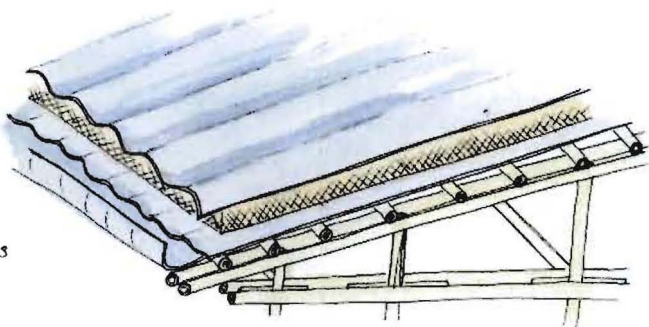
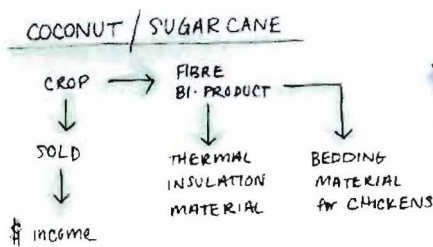
As mentioned prior, the courtyard for communal living and social gathering and the use of the concrete masonry unit or indigenous materials are integral to local Haitian architectural vernacular. By designing the forms of the complex's buildings around the concept of the courtyard as a communal living space, it stays true to this type of building vernacular. Not losing this part of the design was imperative for preserving familial living. It can be seen in each individual residential unit, in the overall formation of the residential units, in the creation of the full set of classroom units, and finally in the large courtyard as you enter the site – a place home to markets and a common gathering space for members of the church.



Supplemental Images

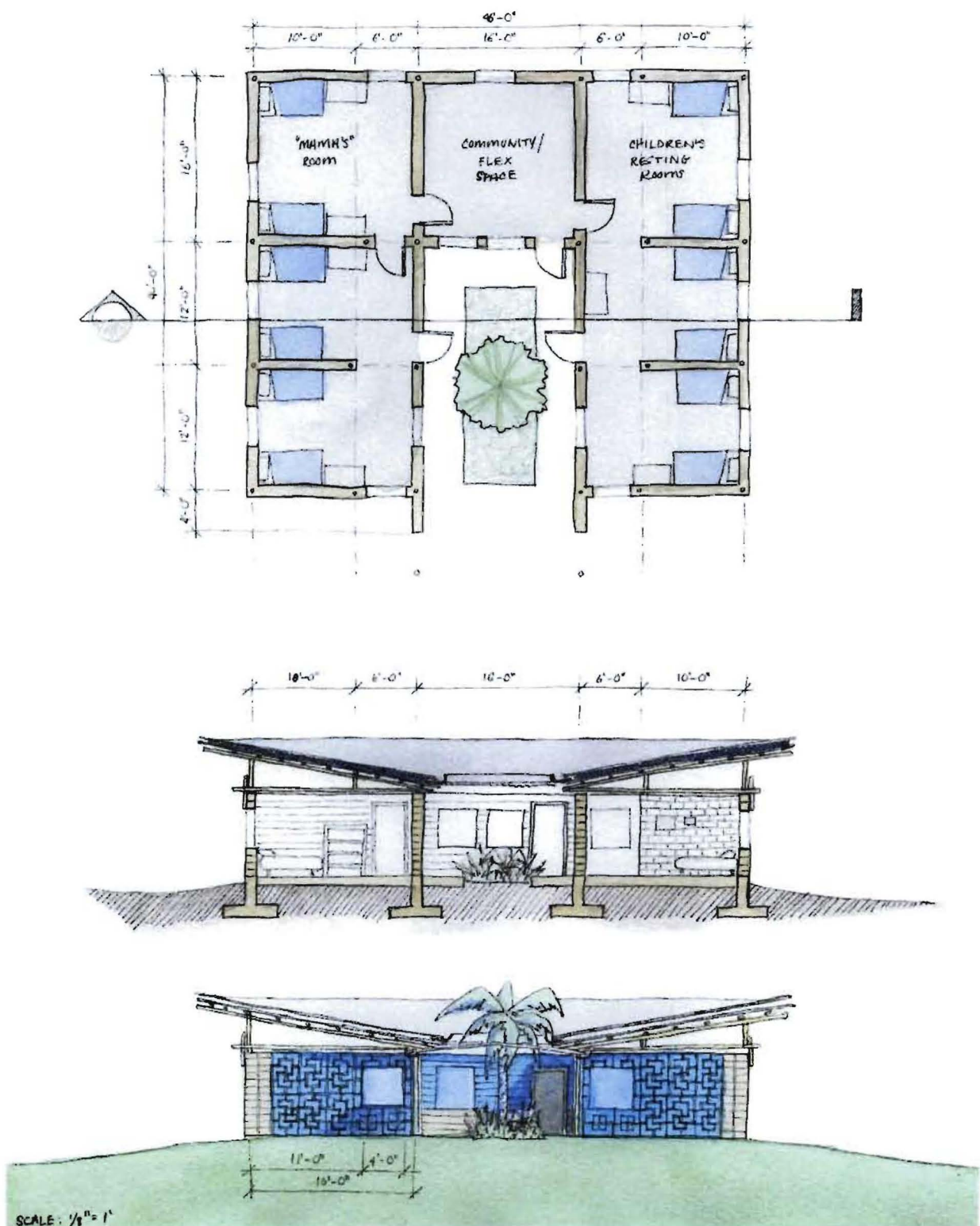


photos of model; details of bamboo trusses

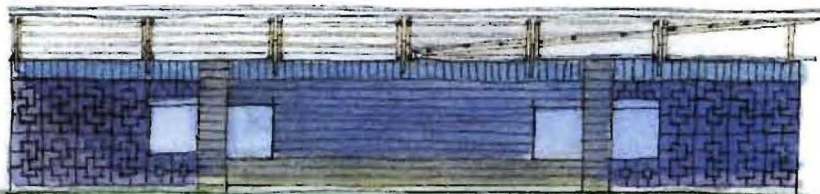
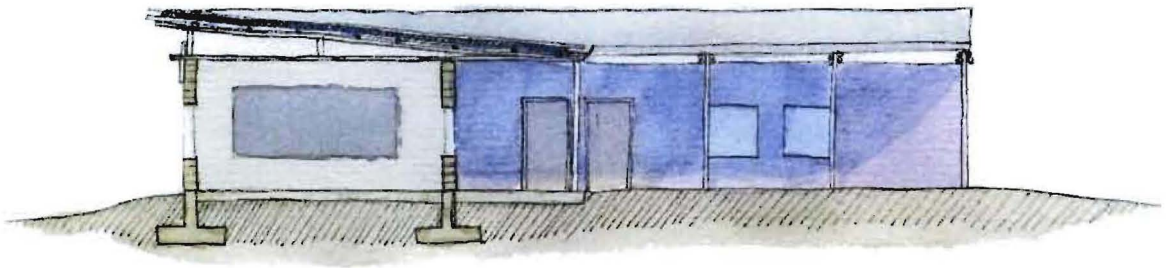
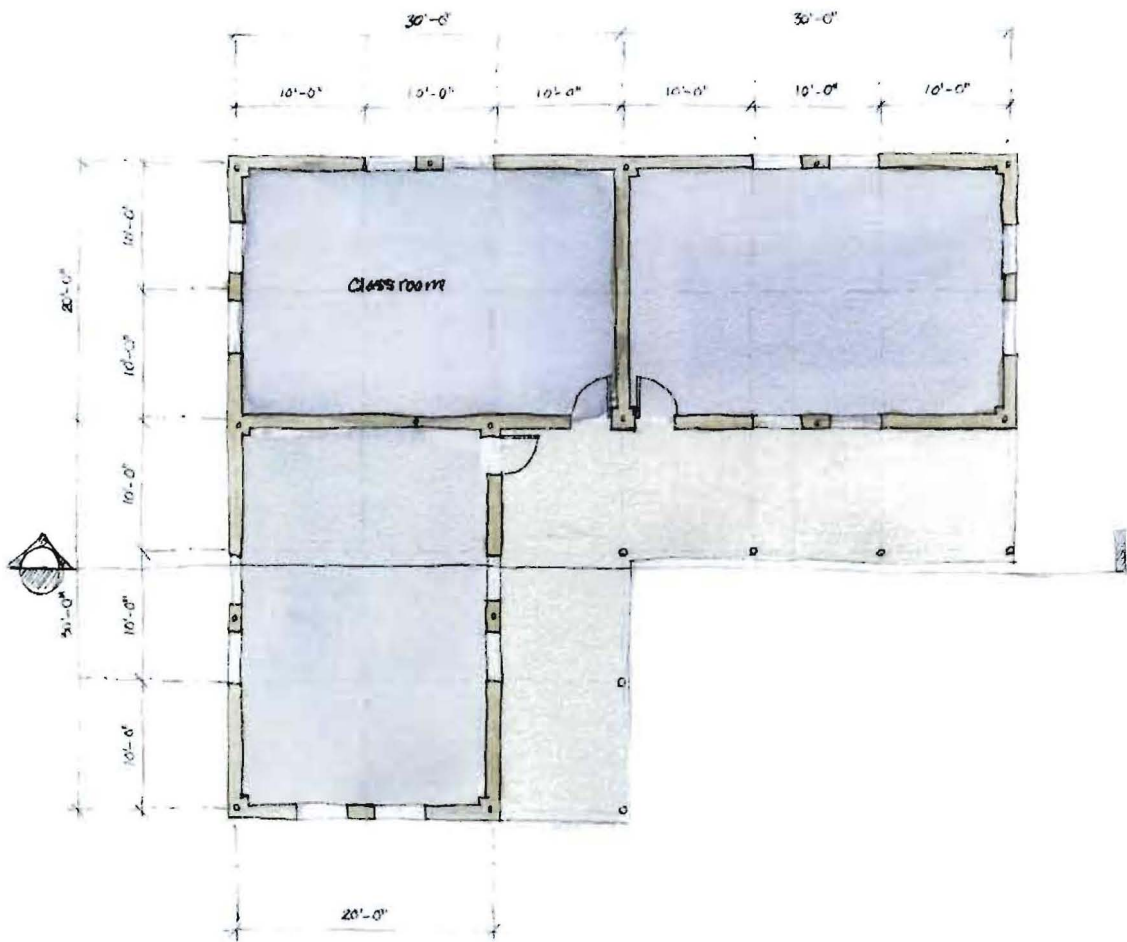








PLAN, SECTION, ELEVATION - residential unit

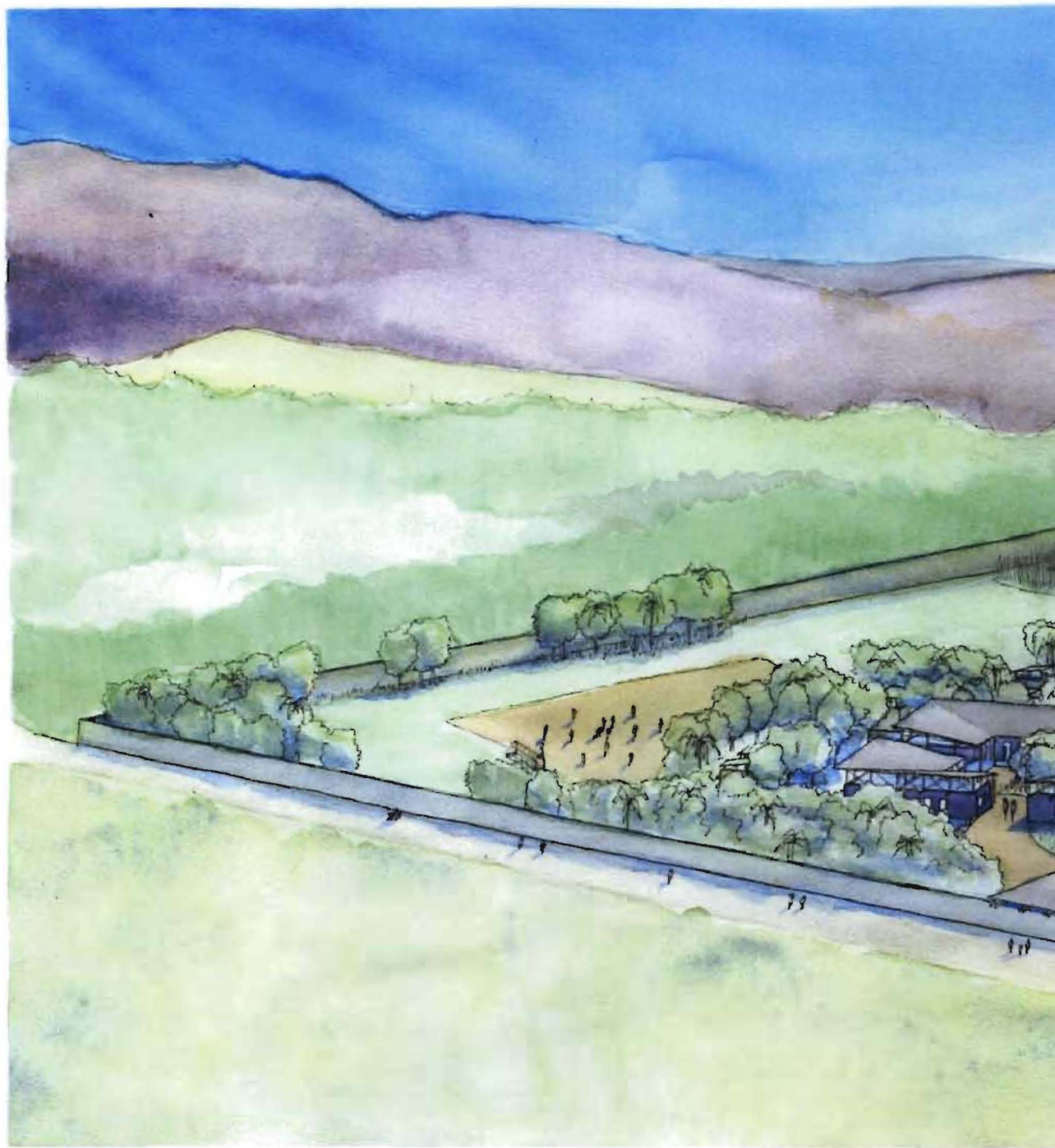


NORTH ELEVATION

SCALE: 1/8" = 1'

PLAN, SECTION, ELEVATION - classroom unit

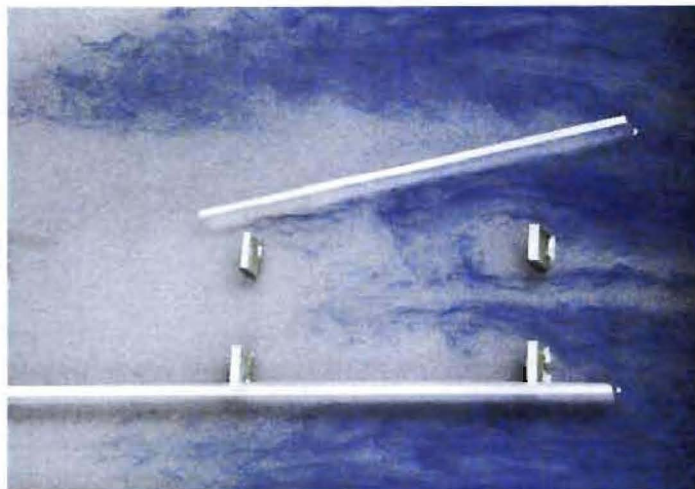




site axonometric drawing







TOP: aerial of Ball State campus showing footprint of site for refrence of scale  
BELOW: image captured when testing forms at the fluid water mapping table

## Works Cited

Brown, G.Z., and Mark DeKay. *Sun, wind & light: architectural design strategies*. 2nd Ed. New York: John Wiley & Sons, Inc., 2001. Print.

Haas, Peter, perf. *Haiti's disaster of engineering*. TED Senior Fellows at TEDGlobal, 2010. Web. Nov 2010. <[http://www.ted.com/talks/lang/en/peter\\_haas\\_haiti\\_s\\_disaster\\_of\\_engineering.html](http://www.ted.com/talks/lang/en/peter_haas_haiti_s_disaster_of_engineering.html)>.

Rapoport, Amos. *House Form and Culture*. Englewood Cliffs, NJ: Prentice Hall, 1969. Print.

Stein, Benjamin, John S. Reynolds, Walter T. Grondzik, and Alison G. Kwok. *Mechanical and Electrical Equipment for Buildings*. 10th ed. Hoboken, new Jersey: John Wiley, 2006. 70. Print.

Xiao, Yan, Masafumi Inoue, and Shyam K. *Modern bamboo structures: proceedings of First International Conference on Modern Bamboo Structures (ICBS-2007)*, Changsha, China, 28-30 October 2007. Taylor & Francis, 2008. Print.

Zarr, Robert R. *Insulation Materials, Testing, Applications*. 4th Volume. ASTM Committee C-16 on thermal insulation.

Sources of referenced precedent examples:

<http://www.anna-heringer.com/>

<http://ethiopiastudio.com/>